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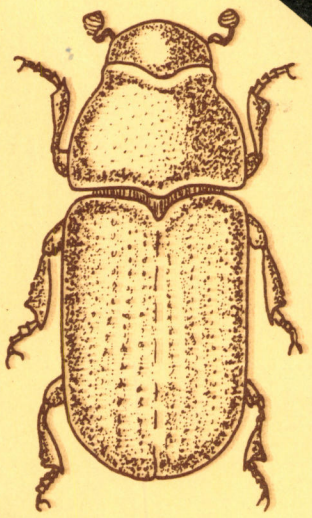
BIOLOGICAL EVALUATION
Dwarf Mistletoe

Mistletoe Timber Sale
Tusayan Ranger District
Kaibab National Forest
Arizona

1976



Southwestern Region

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Kaibab National Forest
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March 1976

Forest Insect and Disease Management
State and Private Forestry
Southwestern Region, Forest Service, USDA
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INTRODUCTION

Southwestern dwarf mistletoe (Arceuthobium vaginatum subsp. cryptopodum (Engelm.) Hawks. and Wiens) on ponderosa pine is the most destructive disease occurring in the Southwest. This disease causes growth loss, deformity, mortality, and reduced seed production in infected trees. Dwarf mistletoe infects ponderosa pines in much of the 8,942-acre Mistletoe timber sale, located on Tusayan Ranger District, Kaibab National Forest, Arizona (Fig. 1). Ranger District personnel have observed several types of mistletoe problems in various parts of the timber sale. Land managers have requested assistance from the Forest Insect and Disease Management Staff Unit in developing a dwarf mistletoe prevention program for specified parts of the sale area.

OBJECTIVE

The objective of this evaluation was to determine the distribution and intensity of dwarf mistletoe within specified parts of the Mistletoe timber sale. This information will be used in establishing a dwarf mistletoe prevention program for the areas evaluated. The need for mistletoe suppression also was considered in the evaluation.

STAND HISTORY AND CURRENT CONDITIONS

The Mistletoe timber sale was harvested in 1967-1969. The silvicultural objective of the sale was to reduce mistletoe levels in an infected overstory. Trees in mistletoe rating classes 3, 4, 5, and 6 were marked for removal (6-class mistletoe rating system, Hawksworth and Lusher 1956). Not all trees in the rating classes given above were removed because of latent mistletoe infections, cutting diameter limits, or trees that were missed during marking or removal.

Several types of silvicultural treatments were completed in the area since the timber sale in 1967-1969 (Fig. 2). Type of treatments, acres treated, and approximate cost of treatments that have been completed or are currently underway are:1/

1. Planting: F.Y. 1974 - 114 acres at a cost of $13,240; F.Y. 1975 - 251 acres at a cost of $31,195.

2. Seeding: F.Y. 1974 - 55 acres at a cost of $1,030; F.Y. 1975 - 150 acres at a cost of $2,365.

3. Site preparation: F.Y. 1974 - 320 acres at a cost of $2,820; F.Y. 1975 - 292 acres at a cost of $2,630.

4. Precommercial thinnings: F.Y. 1974 - 200 acres at a cost of $7,248; F.Y. 1975 - 1,838 acres at a cost of $59,821.

1/ Figures based on Tusayan Ranger District records.

A small area adjacent to the Mistletoe timber sale has been placed in the Special Component due to presence of a historical site (Fig. 2). Dwarf mistletoe occurs in many trees surrounding the historic site. This area, located near Hull Tank, may require a different type of land management to preserve the historic site.

METHODS

The four different dwarf mistletoe situations that required individual evaluation were: a regeneration area, an area scheduled for thinning, a thinned area, and the historic site (Fig. 2). Each type of situation is treated separately herein.

Area 1

The planted and seeded areas were combined and sampled as one unit because the primary management objective in both areas was regeneration of the site. The number of trees, d.b.h., and mistletoe class of residual infected trees were recorded on sample plots. Fixed-size circular plots of 1/20-acre (26' 4"r) were established at a 4-chain interval between plots and lines (Fig. 3). All ponderosa pine trees 4.5 feet and taller were examined and tallied on each plot. Tally trees were rated using the 6-class mistletoe rating system. Field data were processed through the computer program NSEC, which provided a summary of the data.

Area 2

The proposed thinning area (Fig. 4) was surveyed using the third nearest neighbor sampling system. Survey procedure was:

1. The boundary of the area to be sampled was marked.

2. Age measurements were taken from 20 trees representative of the featured age class.

3. Site index measurements were obtained from 12 dominant ponderosa pines within the area sampled.

4. Sample plots were located 4 chains apart along parallel compass lines that were 8 chains apart; sample points were the center of a variable-size plot (maximum radius of 33 feet); each plot was divided into four quadrants by the intersection of a base line at right angles to the compass line; the third nearest live tree ($\geq$ 4.5 feet tall) to plot center in each quadrant was sampled; distance from plot center to the third tree, d.b.h., and presence or absence of dwarf mistletoe were recorded for each tree examined.

5. Survey data were processed through the DENSUR computer program, which summarized field data and provided estimates of average tree density, average tree d.b.h., and percent of trees infected with dwarf mistletoe; summarized data were then combined with various management alternatives obtained from Ranger District personnel and processed through the simulated yield program SWYLD2 (Myers, Edminster, and Hawksworth 1975; Edminster and Hawksworth 1975). The SWYLD2 program simulates yields in even-aged and two-storied stands of ponderosa pine. The program can be used in either dwarf mistletoe-infested or non-infested stands. This management tool allows the land manager to evaluate effects of various cultural operations by comparing yields resulting from each operation.

Area 3

The intensity and distribution of dwarf mistletoe in residual trees of the thinned area were determined by a walk-through survey (Fig. 2). Examination of the area indicated a systematic sample was not necessary due to the widely scattered occurrence of dwarf mistletoe in residuals.

Area 4

The area around Hull Tank historical site was evaluated by a walk-through survey to determine incidence of mistletoe-infected overstory trees. Recommendations for treatment of the area are included in this evaluation.

RESULTS AND DISCUSSION

Survey results and general observations pertaining to each of the aforementioned areas are presented and discussed individually.

Area 1 (Regeneration Areas)

Figures 2 and 3 provide information relative to sampled area boundary, plot location, and acreage surveyed. The sampled area was divided into two sections for data analysis because of substantial variation in tree density and occurrence of dwarf mistletoe between the two sections. Data were collected from 300 sample plots over the 480 acres surveyed.

Table 1 provides survey results relative to tree density, basal area, and dwarf mistletoe situation for each of the two sections, as well as the total area. Dwarf mistletoe-infected trees located in the regeneration area comprise 12 percent of the total trees per acre. Regeneration efforts have not been entirely successful within the sampled area; thus, the surviving trees are of high value. Dwarf mistletoe-infected residuals in the planted and seeded areas provide a source of inoculum for infecting regeneration (Fig. 5).

Table 2 provides information pertaining to number of trees per acre by dwarf mistletoe class and d.b.h. class for each section, as well as the total area. Most trees are in small diameter classes; thus, removal of infected trees could be achieved with relatively little site disturbance and subsequent regeneration losses. Retaining mistletoe-infected overstory trees in the regeneration area will perpetuate dwarf mistletoe problems and eventually cause volume loss and tree mortality.

Area 2 (Proposed Thinning)

This area was divided into two sections for data analysis due to substantial variation in tree density. The following tabulation indicates the area surveyed, number of plot locations, tree density, percent trees infected with dwarf mistletoe, and average d.b.h.:

Area	Acreage	No. plots taken/ No. plots used	Tree density (trees/acre)	Percent DM	Average d.b.h. (inches)
Section 1	525	164/65	410	18	4.1
Section 2	736	230/155	765	20	3.5
Sections 1 & 2	1,261	394/220	671	19	3.7

The reduced number of plots actually used versus those taken resulted from eliminating plots with less than two "count trees."2/ The distribution of trees in Section 1 was somewhat erratic. Dense clumps of saplings were scattered through the area. A thinning operation would be most intense in these clumps, rather than over the entire area. Simulated yield tables, based on the information collected, are presented in Tables 3-13. Tables 3-8 represent Section 1, while Tables 9-13 apply to Section 2. All yield tables were discussed with Ranger District personnel and provided for use in selecting the most appropriate management alternatives. Only a representative sample of the yield tables is included herein.

In evaluating Tables 3-8 for Section 1, several management alternatives are of primary importance. With the exception of Table 4, yields are based on a 20-year cycle. In Table 4, with a 10-year cutting cycle, the thinning at age 40 was not executed because of insufficient excess growing stock available for thinning. A 10-year delay before the first entry in the stand is simulated in Tables 7 and 8. This delay resulted in a buildup of dwarf mistletoe which could not be suppressed by subsequent

2/ "count trees" - a ponderosa pine 4.5 feet or taller, the third nearest tree in the sample quadrant, and within 33 feet of plot center.

entries in the stand. Several thinnings were not completed due to high levels of dwarf mistletoe. When the stand DMR exceeds 3.0, intermediate cuts are not executed. When a dwarf mistletoe infestation reaches this level, the stand should be regenerated because growth loss and mortality caused by dwarf mistletoe outweigh volume production on the area. Variations in total board foot volume per acre are also caused by altering thinning intensities.

In the simulated yields for Section 2, Table 9 indicates yields based on a 10-year cutting cycle. Tables 10-13 simulated a 20-year cutting cycle. The thinnings at ages 40 and/or 50 (Tables 9, 10, and 12) were not completed because of insufficient excess growing stock to meet the commercial minimum specified. Dwarf mistletoe increased substantially in Table 12 because of a high subsequent growing stock level and the bypassed thinning. Reductions in total board foot volume per acre are caused by variations in management alternatives.

Area 3 (Thinned Area)

Pockets of mistletoe-infected residual trees were present in several portions of the thinned area (Fig. 6 & 7). Mistletoe-infected trees generally occurred in small groups of less than 1 acre in size. Scattered, infected residuals were not observed in the thinned area. Residual mistletoe trees were often heavily infected. The rate of spread of dwarf mistletoe from these epicenters will increase due to reduction in tree density (Hawksworth 1961).

Area 4 (Historical Site)

Because the area surrounding Hull tank has been designated a historical site and placed in the Special Component, preservation of this site has high priority as a management option. Dwarf mistletoe-infected trees were scattered throughout much of the area. Overstory trees with one to several mistletoe-caused witches' brooms were located in close proximity to historic buildings. Trees with brooms will eventually succumb to the parasitic effects resulting from infection by dwarf mistletoe.

Large witches' brooms often do not produce an abundance of mistletoe seed due to the age of such infections and the vigor of the host. However, light to moderately-infected understory trees will continue to result in spread of the parasite. Consequently, the forested area surrounding historic buildings will deteriorate due to tree deformity and mortality caused by mistletoe infections. The aesthetic value of large overstory trees in close proximity to the buildings is high. Removal of such trees would substantially alter aesthetic appeal of the immediate area.

CONCLUSIONS AND RECOMMENDATIONS

Based on survey results and general observations, the following conclusions and recommendations can be made:

Area 1 (Regeneration Areas)

Mistletoe-infected overstory trees comprise 12 percent of the total trees per acre in the planted and seeded areas. Spread of dwarf mistletoe from overstory to understory will increase as planting stock matures. A mistletoe-infested stand will be perpetuated if infected residuals are not removed from the planted area in the near future. Forest Service Manual, Chapter 5260, outlines procedures for control of dwarf mistletoe, including prevention of mistletoe infection in regeneration areas. We recommend mistletoe prevention operations, as outlined in FSM 5260, be initiated as soon as possible. Prompt removal of infected overstory trees will reduce the potential for regeneration to become infected.

In order to reduce logging damage to regeneration, an alternative removal method may be desirable. Chemical treatment of large mistletoe-infected residuals may be an acceptable alternative. Removal of large infected trees by treatment with Silvisar and felling small infected trees is the recommended treatment for this area. Personnel from the Forest Insect and Disease Management Staff Unit should be contacted regarding information on chemicals registered as silvicides.

Area 2 (Proposed Thinning)

Various management alternatives have a profound effect on the overall board foot production per acre (Tables 3-13). Improper management of dwarf mistletoe-infected stands can reduce volume production substantially. We recommend use of the simulated yield tables to develop a management plan for the area sampled. The management alternatives that best meet predetermined management objectives should be selected and implemented. Delay in treatment of this mistletoe-infested stand will result in growth loss, tree mortality, and perpetuation of dwarf mistletoe in successive rotations.

Area 3 (Thinned Area)

The small pockets of mistletoe-infected residuals should be treated to reduce spread of the disease. Removal of all class 3 and above mistletoe-infected trees in the thinned area, regardless of size, would result in understocked patches; however, dwarf mistletoe would be reduced to an innocuous level. Growth loss and

tree mortality resulting from infection by dwarf mistletoe would be substantially reduced and the overall long-term benefits far outweigh the initial treatment cost. Failure to treat this dwarf mistletoe situation promptly will have the following consequences: (1) the rate of spread of dwarf mistletoe from these epicenters will increase because of the reduced tree density resulting from the thinning project; (2) heavily-infected trees will die before rotation age; (3) growth loss will occur in moderate to heavily-infected trees; as the disease spreads, more trees will be adversely affected and growth losses will increase proportionately; (4) dwarf mistletoe will be perpetuated because of infections in the next generation of trees.

Area 4 (Historical Site)

Mortality can be anticipated in both overstory and understory trees infected with dwarf mistletoe. Trees that are heavily infected with dwarf mistletoe at the present time will be the first to die, followed by moderate and lightly-infected trees in which dwarf mistletoe will continue to intensify.

Dwarf mistletoe-infected trees located in the proximity of Hull Tank historical site should be treated to reduce the level of mistletoe. Removal of heavily-infected overstory trees is not recommended because (1) these trees are of high aesthetic value; (2) quantities of dwarf mistletoe seed produced by the large witches' brooms frequently found in these trees are low; (3) few understory trees are located close to infected overstory trees. Class 3 and above trees in the understory should be removed to reduce spread of the parasite and eventual tree mortality resulting from dwarf mistletoe infections. This sanitation thinning will improve and maintain the aesthetic appeal of this area for visitors in future years.

Funding for dwarf mistletoe suppression may be available from Forest Insect and Disease Management. Forest Service Manual sections 5232-4 and 5281 outline procedures for obtaining these funds. Personnel from the Forest Insect and Disease Management Staff Unit should be contacted if further information regarding management of dwarf mistletoe-infested stands is necessary.

LITERATURE CITED

Edminster, C. B., and F. G. Hawksworth. 1975. User's guide to SWYLD2: yield tables for even-aged and two-storied stands of southwestern ponderosa pine, including effects of dwarf mistletoe. In press.

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ACKNOWLEDGMENTS

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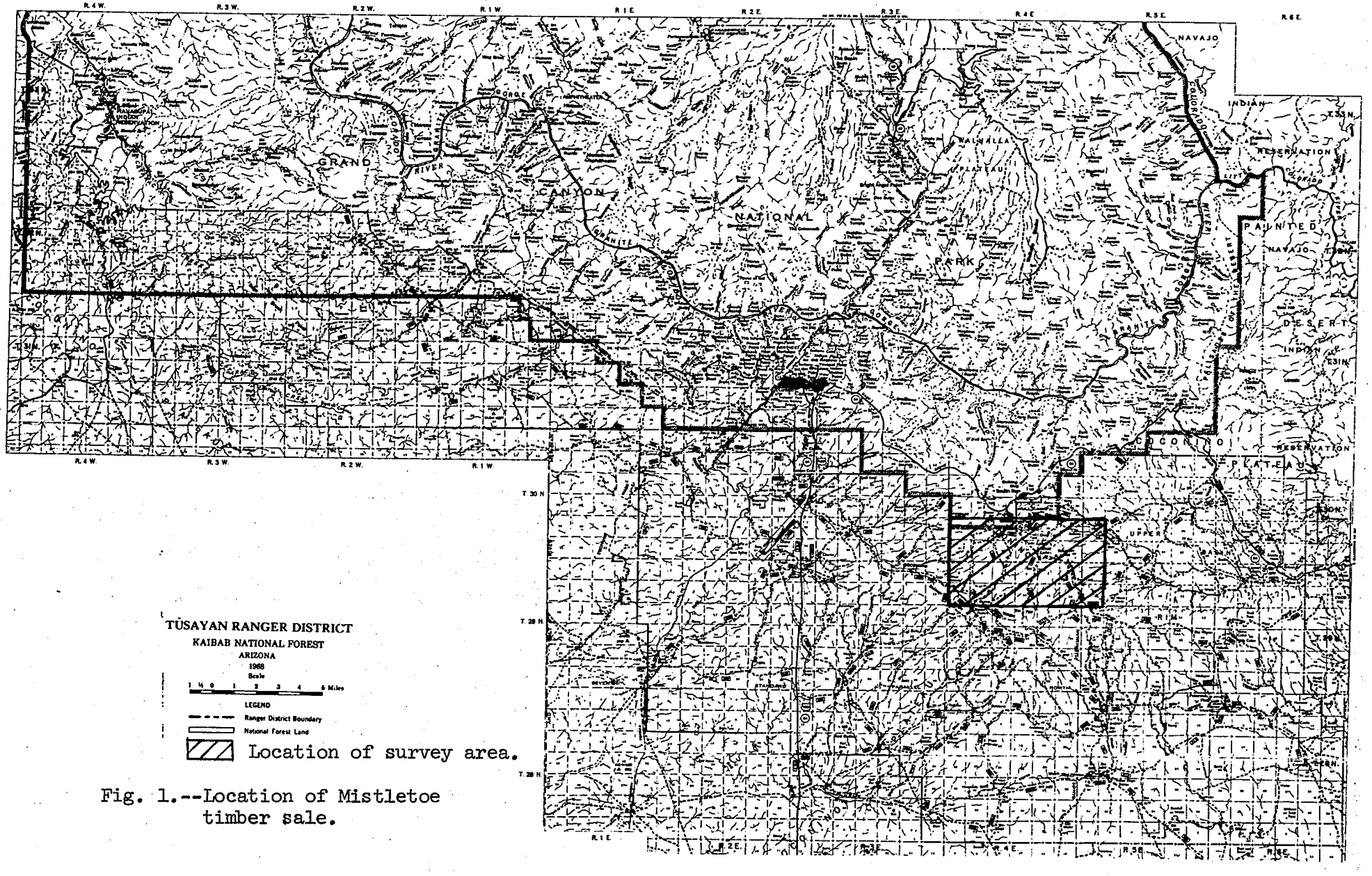
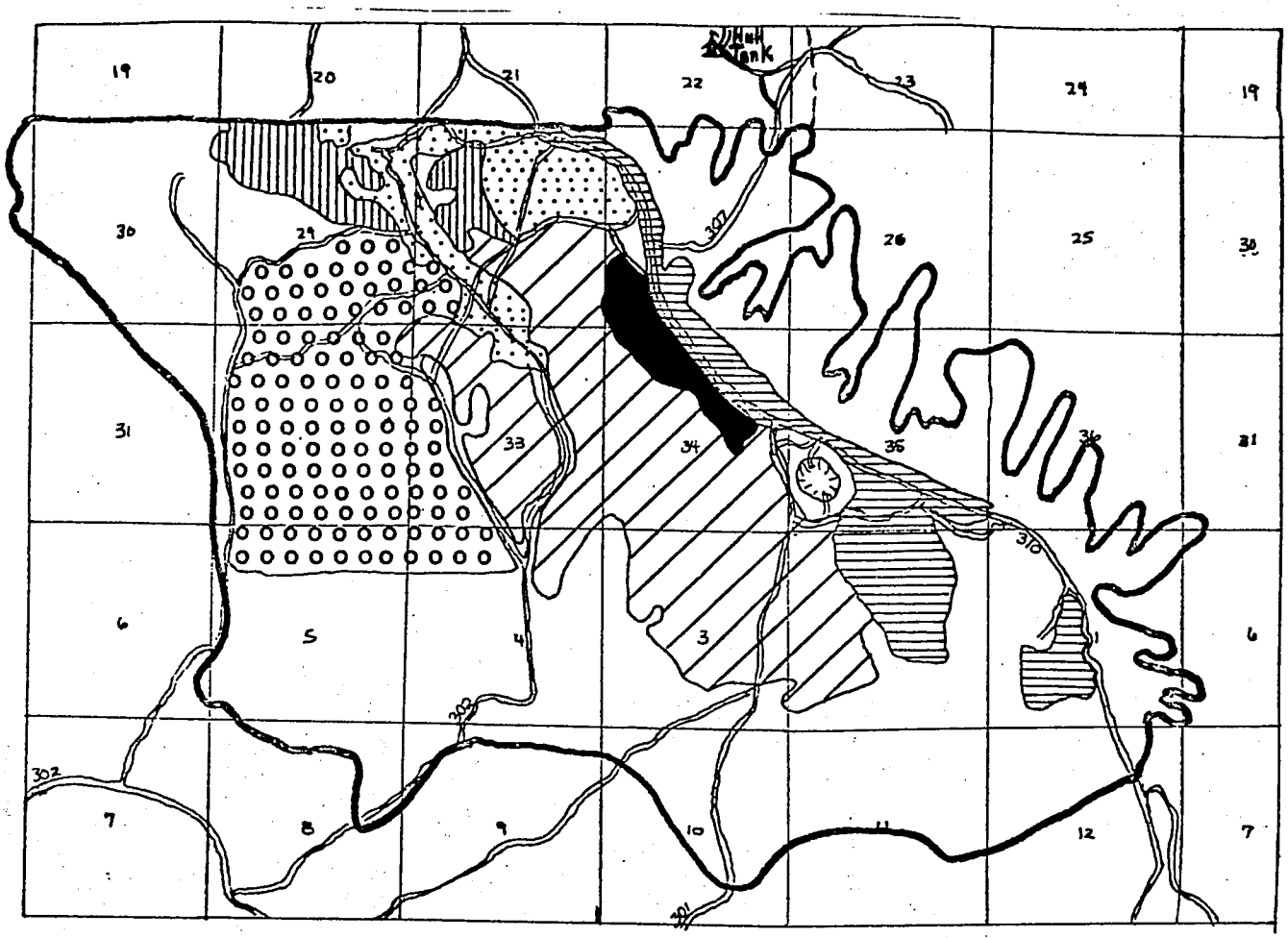
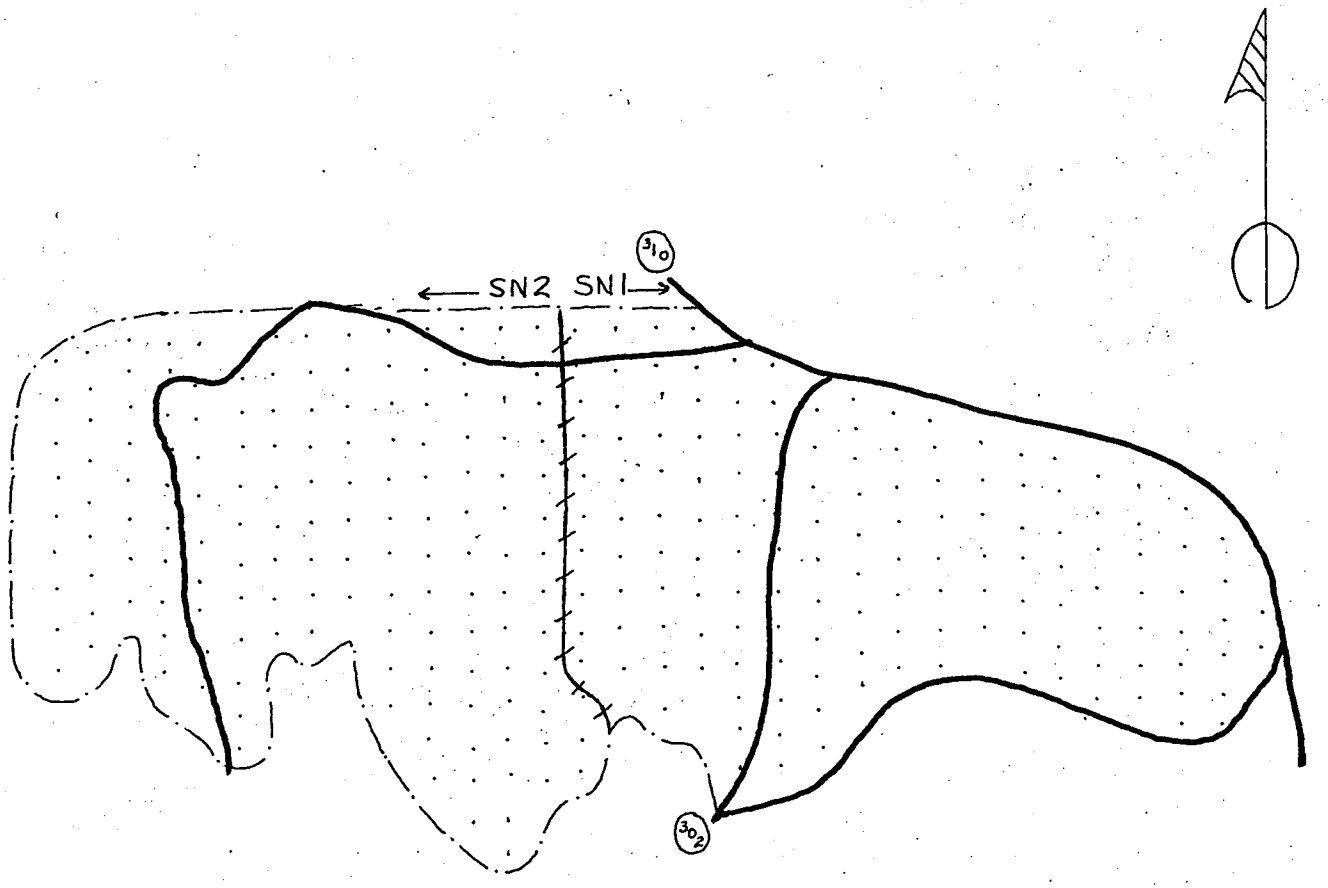


Fig. 1.--Location of Mistletoe timber sale.



LEGEND	
═══	Thinning completed--417 A
///	Thinning in progress--1,621 A
ooo	Thinning proposed--1,098 A
::::	Planting completed--365 A
|||||||	Direct seeding completed--205 A
▬▬	Site preparation completed--174 A
———	Mistletoe timber sale boundary
⛫	Hull Tank Historical Site

Fig. 2.--Silvicultural treatments in the Mistletoe timber sale (F.Y. 1974-75).



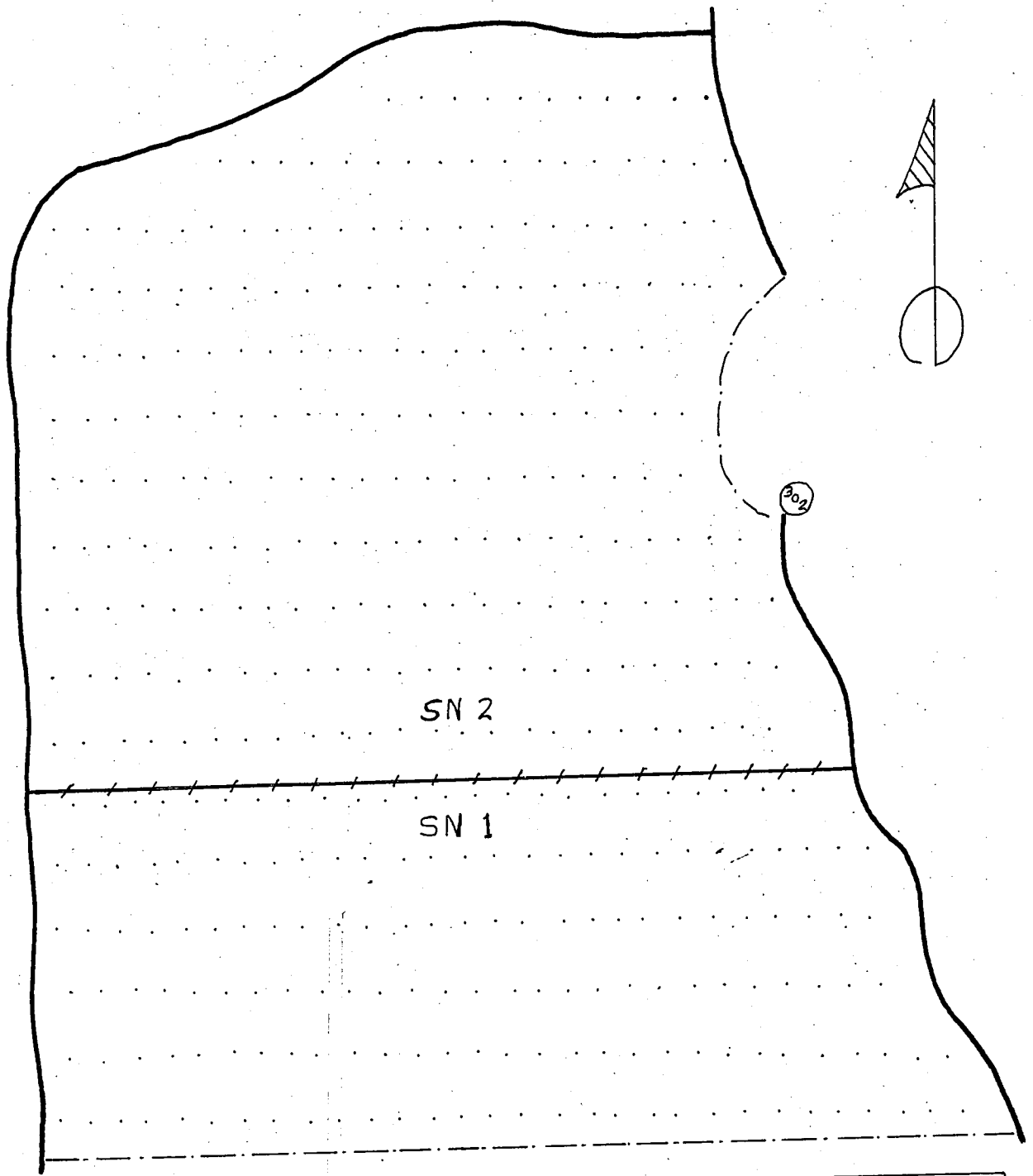
LEGEND

- ● = 4-chain interval plot
- —·— = Survey area boundary
- SN —/— = Section boundary
- O = Forest road

300 Plots
480 Acres

Scale: Approx. 1 cm = 8 chains

Fig. 3.--Distribution of dwarf mistletoe survey plots in planted/seeded areas.



394 Plots
1,261 Acres

Scale: Approx. 1 cm = 8 chains

LEGEND	
·	= 4-chain interval plot
—·—	= Survey area boundary
SN	= Section boundary
O	= Forest road

Fig. 4.--Distribution of dwarf mistletoe plots in proposed thinning area.

Fig. 5 .--Class 6 dwarf mistletoe-infected residual in the planted area.

Fig. 6.--Class 5 dwarf mistletoe-infected residual in thinned area; note numerous witches' brooms caused by the infections.

Fig. 7.--Dwarf mistletoe-infected residual in thinned area; note numerous scattered infections (class 5).

Area sampled	Dwarf mistletoe classes									
	0	1	2	3	4	5	6	3-6	1-6	0-6
Section 1										
Trees/acre	270	7	4	3	1	3	1	8	19	289
% trees/acre	94	2	1	1	.5	1	.5	3	6	100
BA/acre	19	3	1	1	.5	.5	0+	2	6	25
% BA/acre	77	11	4	3	2	2	1	8	23	100
Section 2										
Trees/acre	132	13	8	4	7	2	1	14	35	167
% trees/acre	79	8	5	2	4	1	1	8	21	100
BA/acre	13	2.5	1	1	.5	0+	0+	1.5	5	18
% BA/acre	70	15	6	4	3	1.5	.5	9	30	100
Sections 1 & 2										
Trees/acre	201	10	6	3	4	2	1	10	25	226
% trees/acre	88	4	3	1.5	2	1	.5	5	12	100
BA/acre	16	3	1	1	.5	.5	0+	2	6	22
% BA/acre	74	12	5	4	2	2	1	9	26	100

Table 1.--Summary of trees per acre and basal area by dwarf mistletoe class for the planted/seeded area. (Area 1).

D.b.h. class (inches)	Number of trees per acre					
	DM Class-Sec. 1		DM Class-Sec. 2		DM Class-Sec. 1 & 2	
	0	1-6	0	1-6	0	1-6
.9-1.9	135	6	43	13	89	8.5
2.0-2.9	68	1	28	4	48	2.5
3.0-3.9	21	1	21	4	21	2.5
4.0-4.9	18	1	14	3	16	2
5.0-5.9	5	2	5	2	5	2
6.0-6.9	5	1	7	2	6	1
7.0-7.9	4	2	3	2	3.5	2
8.0-8.9	3	1	3	1	3	1
9.0-9.9	2	.5	1	.5	1.5	.5
10.0-10.9	1	.5	1	1	1	1
11.0-11.9	1	1	1	.5	1	1
12.0-30.9	7	2	5	2	6	2
Total	270	19	132	35	201	26

Table 2.--Number of trees per acre by diameter class and dwarf mistletoe rating class in the planted/seeded area.

YIELDS PER ACRE OF SOUTHWESTERN PONDEROSA PINE, STAND NUMBER 1.

SITE INDEX 77
THINNING INTENSITY-- INITIAL- 80. SUBSEQUENT- 110.

KAIBAB NF TUSAYAN RD MTS UNPLANTED BEFORE THINNING 1975

		CHARACTERISTICS BEFORE AND AFTER THINNING							PERIODIC INTERMEDIATE CUTS				
STAND AGE (YEARS)	DMR	TREES NO.	BASAL AREA SQ.FT.	AVERAGE D.B.H. IN.	AVERAGE HEIGHT FT.	TOTAL VOLUME CU.FT.	MERCHANTABLE VOLUME CU.FT.	SAWTIMBER VOLUME BD.FT.	TREES NO.	BASAL AREA SQ.FT.	TOTAL VOLUME CU.FT.	MERCHANTABLE VOLUME CU.FT.	SAWTIMBER VOLUME BD.FT.
30	.2	410	38	4.1	28	570	0	0					
30	.0	397	36	4.1	28	550	0	0	13	2	20	0	0
40	.1	395	70	5.7	38	1090	470	0					
50	.2	392	102	6.9	48	1820	1260	0					
50	.0	331	91	7.1	48	1630	1170	0	61	11	190	90	0
60	.1	328	117	8.1	55	2310	1890	900					
70	.1	323	143	9.0	62	3200	2780	3700					
70	.0	229	108	9.3	63	2440	2140	3100	94	35	760	640	600
80	.1	227	129	10.2	69	3270	2940	6900					
90	.1	227	150	11.0	74	4140	3770	12000					
90	.0	158	110	11.3	75	3060	2790	9400	69	40	1080	980	2600
100	.1	158	128	12.2	79	3810	3520	12700					
110	.1	158	146	13.0	83	4560	4250	16000					
110	.0	58	67	14.5	85	2130	2000	8100	100	79	2430	2250	7900
120	.1	58	79	15.8	88	2640	2510	10800					
130	.1	58	91	17.0	91	3170	3030	13700					
130	.0	17	33	18.8	93	1160	1120	5500	41	58	2010	1910	8200
140	.1	17	39	20.6	95	1440	1390	7300					
150	.1	17	46	22.3	98	1730	1680	9400					
							TOTAL YIELDS				8220	7550	28700

MERCH. CU. FT. = TREES 6.0 INCHES D.B.H. AND LARGER TO 4.0-INCH TOP.
BD. FT. = TREES 10.0 INCHES D.B.H. AND LARGER TO VARIABLE TOP LIMIT.
INITIAL THINNING MUST BE FROM BELOW.
DWARF MISTLETOE RATING ABOVE WHICH PERIODIC THINNINGS WILL NOT BE EXECUTED = 3.0.
MINIMUM CUTS FOR INCLUSION IN TOTAL YIELDS-- 1. CUBIC FEET AND 1. BOARD FEET.

ALL THINNINGS MAY BE NONCOMMERCIAL.
AT INITIAL AGE 30., 18. PERCENT OF THE TREES WERE INFECTED WITH DWARF MISTLETOE.

Table 3

YIELDS PER ACRE OF SOUTHWESTERN PONDEROSA PINE, STAND NUMBER 1.

SITE INDEX 77
THINNING INTENSITY-- INITIAL= 80. SUBSEQUENT= 110.

KAIBAB NF TUSAYAN RD MTS UNPLANTED BEFORE THINNING 1975

CHARACTERISTICS BEFORE AND AFTER THINNING									PERIODIC INTERMEDIATE CUTS				
STAND AGE (YEARS)	DMR	TREES NO.	BASAL AREA SQ.FT.	AVERAGE D.B.H. IN.	AVERAGE HEIGHT FT.	TOTAL VOLUME CU.FT.	MERCHANTABLE VOLUME CU.FT.	SAWTIMBER VOLUME BD.FT.	TREES NO.	BASAL AREA SQ.FT.	TOTAL VOLUME CU.FT.	MERCHANTABLE VOLUME CU.FT.	SAWTIMBER VOLUME BD.FT.
30	.2	410	38	4.1	28	570	0	0					
30	.0	397	36	4.1	28	550	0	0	13	2	20	0	0
40	.1	395	70	5.7	38	1090	470	0					
40	.1	395	70	5.7	38	1090	470	0	0	0	0	0	0
50	.2	392	102	6.9	48	1820	1260	0					
50	.0	331	91	7.1	48	1630	1170	0	61	11	190	90	0
60	.1	328	117	8.1	55	2310	1890	1000					
60	.0	272	102	8.3	55	2010	1670	1000	56	15	300	220	0
70	.1	269	127	9.3	63	2870	2520	3800					
70	.0	221	109	9.5	63	2470	2180	3600	48	18	400	340	200
80	.1	219	129	10.4	69	3290	2970	7500					
80	.0	179	110	10.6	70	2800	2540	6800	40	19	490	430	700
90	.1	179	129	11.5	75	3590	3290	12000					
90	.0	147	110	11.7	75	3060	2810	9900	32	19	530	480	2100
100	.1	147	127	12.6	79	3790	3520	13000					
100	.0	123	110	12.8	80	3290	3050	11400	24	17	500	470	1600
110	.1	123	126	13.7	83	3970	3720	14500					
110	.0	54	66	15.0	85	2120	2010	8300	69	60	1850	1710	6200
120	.1	54	78	16.3	88	2620	2500	11000					
130	.1	54	90	17.5	91	3130	3000	13900					
130	.0	16	32	19.2	93	1140	1100	5500	38	58	1990	1900	8400
140	.1	16	39	21.1	96	1420	1380	7300					
150	.1	16	45	22.8	98	1700	1660	9400					
							TOTAL YIELDS				7970	7300	28600

MERCH. CU. FT. = TREES 6.0 INCHES D.B.H. AND LARGER TO 4.0-INCH TOP.

BD. FT. = TREES 10.0 INCHES D.B.H. AND LARGER TO VARIABLE TOP LIMIT.
INITIAL THINNING MUST BE FROM BELOW.
DWARF MISTLETOE RATING ABOVE WHICH PERIODIC THINNINGS WILL NOT BE EXECUTED = 3.0.
MINIMUM CUTS FOR INCLUSION IN TOTAL YIELDS-- 1. CUBIC FEET AND 1. BOARD FEET.
ALL THINNINGS MAY BE NONCOMMERCIAL.
AT INITIAL AGE 30., 18. PERCENT OF THE TREES WERE INFECTED WITH DWARF MISTLETOE.
NOTE THAT NOT ALL SCHEDULED THINNINGS WERE POSSIBLE.

Table 4

YIELDS PER ACRE OF SOUTHWESTERN PONDEROSA PINE, STAND NUMBER 1.

SITE INDEX 77

THINNING INTENSITY-- INITIAL= 80. SUBSEQUENT= 100.

KAIBAB NF TUSAYAN RD MTS UNPLANTED BEFORE THINNING 1975

		CHARACTERISTICS BEFORE AND AFTER THINNING							PERIODIC INTERMEDIATE CUTS				
STAND AGE (YEARS)	DMR	TREES NO.	BASAL AREA SQ.FT.	AVERAGE D.B.H. IN.	AVERAGE HEIGHT FT.	TOTAL VOLUME CU.FT.	MERCHANTABLE VOLUME CU.FT.	SAWTIMBER VOLUME BD.FT.	TREES NO.	BASAL AREA SQ.FT.	TOTAL VOLUME CU.FT.	MERCHANTABLE VOLUME CU.FT.	SAWTIMBER VOLUME BD.FT.
30	.2	410	38	4.1	28	570	0	0					
30	.0	397	36	4.1	28	550	0	0	13	2	20	0	0
40	.1	395	70	5.7	38	1090	470	0					
50	.2	392	102	6.9	48	1820	1260	0					
50	.0	301	83	7.1	48	1480	1070	0	91	19	340	190	0
60	.1	299	110	8.2	55	2160	1780	1000					
70	.1	295	133	9.1	63	3000	2610	3600					
70	.0	204	98	9.4	63	2230	1960	3000	91	35	770	650	600
80	.1	203	120	10.4	69	3050	2750	6900					
90	.1	203	141	11.3	74	3920	3580	12400					
90	.0	134	100	11.7	75	2790	2570	9100	69	41	1130	1010	3300
100	.1	134	118	12.7	80	3520	3270	12100					
110	.1	134	135	13.6	83	4260	3980	15500					
110	.0	48	60	15.1	85	1920	1810	7600	86	75	2340	2170	7900
120	.1	48	71	16.5	88	2390	2280	10100					
130	.1	48	83	17.8	91	2880	2770	13000					
130	.0	14	29	19.5	93	1030	1000	5000	34	54	1850	1770	8000
140	.1	14	35	21.4	96	1280	1250	6700					
150	.1	14	41	23.2	98	1540	1510	8600					
							TOTAL YIELDS				7990	7300	28400

MERCH. CU. FT. = TREES 6.0 INCHES D.B.H. AND LARGER TO 4.0-INCH TOP.
BD. FT. = TREES 10.0 INCHES D.B.H. AND LARGER TO VARIABLE TOP LIMIT.
INITIAL THINNING MUST BE FROM BELOW.
DWARF MISTLETOE RATING ABOVE WHICH PERIODIC THINNINGS WILL NOT BE EXECUTED = 3.0.
MINIMUM CUTS FOR INCLUSION IN TOTAL YIELDS-- 1. CUBIC FEET AND 1. BOARD FEET.

ALL THINNINGS MAY BE NONCOMMERCIAL.
AT INITIAL AGE 30., 18. PERCENT OF THE TREES WERE INFECTED WITH DWARF MISTLETOE.

Table 5

YIELDS PER ACRE OF SOUTHWESTERN PONDEROSA PINE, STAND NUMBER 1.

SITE INDEX 77
THINNING INTENSITY-- INITIAL= 80. SUBSEQUENT= 90.

KAIBAB NF TUSAYAN RD MTS UNPLANTED BEFORE THINNING 1975

CHARACTERISTICS BEFORE AND AFTER THINNING									PERIODIC INTERMEDIATE CUTS				
STAND AGE (YEARS)	DMR	TREES NO.	BASAL AREA SQ.FT.	AVERAGE D.B.H. IN.	AVERAGE HEIGHT FT.	TOTAL VOLUME CU.FT.	MERCHANTABLE VOLUME CU.FT.	SAWTIMBER VOLUME BD.FT.	TREES NO.	BASAL AREA SQ.FT.	TOTAL VOLUME CU.FT.	MERCHANTABLE VOLUME CU.FT.	SAWTIMBER VOLUME BD.FT.
30	.2	410	38	4.1	28	570	0	0					
30	.0	397	36	4.1	28	550	0	0	13	2	20	0	0
40	.1	395	70	5.7	38	1090	470	0					
50	.2	392	102	6.9	48	1820	1260	0					
50	.0	266	75	7.2	49	1350	980	0	126	27	470	280	0
60	.1	264	102	8.4	56	2000	1670	1100					
70	.1	262	126	9.4	63	2860	2520	4100					
70	.0	171	90	9.8	64	2050	1820	3400	91	36	810	700	700
80	.1	170	110	10.9	70	2830	2570	7600					
90	.1	170	129	11.8	75	3600	3310	11700					
90	.0	111	90	12.2	75	2530	2340	8500	59	39	1070	970	3200
100	.1	111	107	13.3	80	3220	3000	11500					
110	.1	111	124	14.3	84	3920	3690	14800					
110	.0	39	54	15.9	85	1740	1650	7100	72	70	2180	2040	7700
120	.1	39	64	17.4	89	2170	2080	9600					
130	.1	39	75	18.8	92	2630	2530	12300					
130	.0	12	28	20.6	93	990	960	5000	27	47	1640	1570	7300
140	.1	12	33	22.6	96	1230	1200	6700					
150	.1	12	39	24.5	98	1480	1460	8700					
							TOTAL YIELDS				7670	7020	27600

MERCH. CU. FT. - TREES 6.0 INCHES D.B.H. AND LARGER TO 4.0-INCH TOP.
BD. FT. - TREES 10.0 INCHES D.B.H. AND LARGER TO VARIABLE TOP LIMIT.
INITIAL THINNING MUST BE FROM BELOW.
DWARF MISTLETOE RATING ABOVE WHICH PERIODIC THINNINGS WILL NOT BE EXECUTED - 3.0.
MINIMUM CUTS FOR INCLUSION IN TOTAL YIELDS-- 1. CUBIC FEET AND 1. BOARD FEET.

ALL THINNINGS MAY BE NONCOMMERCIAL.
AT INITIAL AGE 30., 18. PERCENT OF THE TREES WERE INFECTED WITH DWARF MISTLETOE.

Table 6

YIELDS PER ACRE OF SOUTHWESTERN PONDEROSA PINE, STAND NUMBER 1.

SITE INDEX 77

THINNING INTENSITY-- INITIAL= 80. SUBSEQUENT= 100.

KAIBAB NF TUSAYAN RD MTS UNPLANTED BEFORE THINNING 1975

		CHARACTERISTICS BEFORE AND AFTER THINNING							PERIODIC INTERMEDIATE CUTS				
STAND AGE (YEARS)	DMR	TREES NO.	BASAL AREA SQ.FT.	AVERAGE D.B.H. IN.	AVERAGE HEIGHT FT.	TOTAL VOLUME CU.FT.	MERCHANTABLE VOLUME CU.FT.	SAWTIMBER VOLUME BD.FT.	TREES NO.	BASAL AREA SQ.FT.	TOTAL VOLUME CU.FT.	MERCHANTABLE VOLUME CU.FT.	SAWTIMBER VOLUME BD.FT.
30	.2	410	38	4.1	28	570	0	0					
40	.7	408	72	5.7	38	1130	480	0					
40	.2	288	57	6.0	39	870	440	0	120	15	260	40	0
50	.6	286	83	7.3	48	1480	1100	0					
60	1.0	284	109	8.4	55	2150	1800	1300					
60	.6	235	95	8.6	56	1870	1580	1300	49	14	280	220	0
70	1.1	233	117	9.6	63	2660	2360	4200					
80	1.9	218	131	10.5	69	3330	3020	7900					
80	1.5	157	100	10.8	70	2560	2320	6600	61	31	770	700	1300
90	2.3	145	110	11.8	75	3060	2820	10000					
100	3.1	129	113	12.7	79	3370	3130	11600					
100	3.1	129	113	12.7	79	3370	3130	11600	0	0	0	0	0
110	3.9	110	111	13.6	83	3470	3250	12600					
110	3.1	50	60	14.8	84	1900	1790	7400	60	51	1570	1460	5200
120	3.8	43	62	16.2	87	2040	1940	8500					
130	4.4	36	61	17.6	90	2090	2010	9300					
130	5.6	15	29	18.9	92	1020	980	4800	21	32	1070	1030	4500
140	4.4	15	35	20.8	94	1270	1240	6500					
150	5.2	12	33	22.5	96	1220	1200	6700					
							TOTAL YIELDS				5170	4650	17700

MERCH. CU. FT. = TREES 6.0 INCHES D.B.H. AND LARGER TO 4.0-INCH TOP.
BD. FT. = TREES 10.0 INCHES D.B.H. AND LARGER TO VARIABLE TOP LIMIT.
INITIAL THINNING MUST BE FROM BELOW.
DWARF MISTLETOE RATING ABOVE WHICH PERIODIC THINNINGS WILL NOT BE EXECUTED = 3.0.
MINIMUM CUTS FOR INCLUSION IN TOTAL YIELDS-- 1. CUBIC FEET AND 1. BOARD FEET.

ALL THINNINGS MAY BE NONCOMMERCIAL.
AT INITIAL AGE 50., 18. PERCENT OF THE TREES WERE INFECTED WITH DWARF MISTLETOE.
NOTE THAT NOT ALL SCHEDULED THINNINGS WERE POSSIBLE.

Table 7

YIELDS PER ACRE OF SOUTHWESTERN PONDEROSA PINE, STAND NUMBER 1.

SITE INDEX 77

THINNING INTENSITY-- INITIAL= 120. SUBSEQUENT= 120.

KAIBAB NF TUSAYAN RD MTS UNPLANTED BEFORE THINNING 1975

CHARACTERISTICS BEFORE AND AFTER THINNING									PERIODIC INTERMEDIATE CUTS				
STAND AGE (YEARS)	DMR	TREES NO.	BASAL AREA SQ.FT.	AVERAGE D.B.H. IN.	AVERAGE HEIGHT FT.	TOTAL VOLUME CU.FT.	MERCHANTABLE VOLUME CU.FT.	SAWTIMBER VOLUME BD.FT.	TREES NO.	BASAL AREA SQ.FT.	TOTAL VOLUME CU.FT.	MERCHANTABLE VOLUME CU.FT.	SAWTIMBER VOLUME BD.FT.
30	.2	410	38	4.1	28	570	0	0					
40	.7	408	72	5.7	38	1130	480	0					
40	.7	408	72	5.7	38	1130	480	0	0	0	0	0	0
50	1.1	405	105	6.9	48	1880	1300	0					
60	1.9	374	124	7.8	55	2450	1940	0					
60	1.6	312	109	8.0	55	2150	1740	0	62	15	300	200	0
70	2.5	282	122	8.9	62	2660	2290	2700					
80	3.3	245	126	9.7	68	3140	2780	5200					
80	3.3	245	126	9.7	68	3140	2780	5200	0	0	0	0	0
90	4.1	205	123	10.5	74	3340	3030	7900					
100	5.0	164	114	11.3	78	3310	3030	10200					
100	5.0	164	114	11.3	78	3310	3030	10200	0	0	0	0	0
110	5.4	126	101	12.1	82	3070	2830	10200					
110	5.0	79	72	12.9	82	2210	2060	7700	47	29	860	770	2500
120	5.4	62	66	14.0	86	2140	2010	7900					
130	5.7	48	60	15.2	88	2020	1920	8000					
130	5.1	25	36	16.2	89	1210	1150	5100	23	24	810	770	2900
140	5.4	20	35	17.8	92	1210	1160	5400					
150	5.6	16	33	19.4	94	1180	1140	5700					
TOTAL YIELDS											3150	2880	11100

MERCH. CU. FT. = TREES 6.0 INCHES D.B.H. AND LARGER TO 4.0-INCH TOP.
BD. FT. = TREES 10.0 INCHES D.B.H. AND LARGER TO VARIABLE TOP LIMIT.
INITIAL THINNING MUST BE FROM BELOW.
DWARF MISTLETOE RATING ABOVE WHICH PERIODIC THINNINGS WILL NOT BE EXECUTED = 3.0.
MINIMUM CUTS FOR INCLUSION IN TOTAL YIELDS-- 1. CUBIC FEET AND 1. BOARD FEET.

ALL THINNINGS MAY BE NONCOMMERCIAL.
AT INITIAL AGE 30., 18. PERCENT OF THE TREES WERE INFECTED WITH DWARF MISTLETOE.
NOTE THAT NOT ALL SCHEDULED THINNINGS WERE POSSIBLE.

Table 8

YIELDS PER ACRE OF SOUTHWESTERN PONDEROSA PINE, STAND NUMBER 2.

SITE INDEX 77
THINNING INTENSITY-- INITIAL= 110. SUBSEQUENT= 120.

KAIBAB NF TUSAYAN RD MTS UNPLANTED BEFORE THINNING 1975

CHARACTERISTICS BEFORE AND AFTER THINNING

STAND AGE (YEARS)	DMR	TREES NO.	BASAL AREA SQ.FT.	AVERAGE D.B.H. IN.	AVERAGE HEIGHT FT.	TOTAL VOLUME CU.FT.	MERCHANTABLE VOLUME CU.FT.	SAWTIMBER VOLUME BD.FT.
30	.2	765	51	3.5	28	890	0	0
30	.0	585	44	3.7	29	730	0	0
40	.1	581	86	5.2	38	1410	430	0
40	.1	581	86	5.2	38	1410	430	0
50	.2	573	120	6.2	48	2230	1230	0
50	.2	573	120	6.2	48	2230	1230	0
60	.6	557	157	7.2	58	3300	2410	0
60	.0	333	105	7.6	58	2200	1700	0
70	.2	329	130	8.5	66	2990	2510	2200
70	.0	277	114	8.7	66	2640	2250	2200
80	.1	274	138	9.6	72	3630	3220	5900
80	.0	228	119	9.8	72	3160	2810	5500
90	.1	226	141	10.7	78	4060	3690	10600
90	.0	185	120	10.9	78	3460	3150	9400
100	.1	185	140	11.8	82	4330	3980	14100
100	.0	153	120	12.0	83	3720	3430	12300
110	.1	153	139	12.9	86	4520	4210	15800
110	.0	126	120	13.1	87	3910	3650	13800
120	.1	128	137	14.0	90	4660	4380	17500
120	.0	45	60	15.6	92	2080	1970	8400
130	.1	45	71	17.0	95	2550	2440	11100
140	.1	45	82	18.3	97	3050	2930	14000

PERIODIC INTERMEDIATE CUTS

TREES NO.	BASAL AREA SQ.FT.	TOTAL VOLUME CU.FT.	MERCHANTABLE VOLUME CU.FT.	SAWTIMBER VOLUME BD.FT.
180	7	160	0	0
0	0	0	0	0
0	0	0	0	0
224	52	1100	710	0
52	16	350	260	0
46	19	470	410	400
41	21	600	540	1200
32	20	610	550	1800
25	19	610	560	2000
83	77	2580	2410	8900
TOTAL YIELDS		9530	8470	27900

MERCH. CU. FT. = TREES 6.0 INCHES D.B.H. AND LARGER TO 4.0-INCH TOP.
BD. FT. = TREES 10.0 INCHES D.B.H. AND LARGER TO VARIABLE TOP LIMIT.
INITIAL THINNING MUST BE FROM BELOW.

DWARF MISTLETOE RATING ABOVE WHICH PERIODIC THINNINGS WILL NOT BE EXECUTED = 5.0.
MINIMUM CUTS FOR INCLUSION IN TOTAL YIELDS-- 260. CUBIC FEET AND 1000. BOARD FEET.
PRECOMMERCIAL INITIAL THINNING ALLOWED. NONCOMMERCIAL SUBSEQUENT THINNINGS NOT ALLOWED.
AT INITIAL AGE 30., 20. PERCENT OF THE TREES WERE INFECTED WITH DWARF MISTLETOE.
NOTE THAT NOT ALL SCHEDULED THINNINGS WERE POSSIBLE.

Table 9

YIELDS PER ACRE OF SOUTHWESTERN PONDEROSA PINE, STAND NUMBER 2.

SITE INDEX 77

THINNING INTENSITY-- INITIAL- 110, SUBSEQUENT- 120.

KAIBAB NF TUSAYAN RD MTS UNPLANTED BEFORE THINNING 1975

		CHARACTERISTICS BEFORE AND AFTER THINNING							PERIODIC INTERMEDIATE CUTS				
STAND AGE (YEARS)	DMR	TREES NO.	BASAL AREA SQ.FT.	AVERAGE D.B.H. IN.	AVERAGE HEIGHT FT.	TOTAL VOLUME CU.FT.	MERCHANTABLE VOLUME CU.FT.	SAWTIMBER VOLUME BD.FT.	TREES NO.	BASAL AREA SQ.FT.	TOTAL VOLUME CU.FT.	MERCHANTABLE VOLUME CU.FT.	SAWTIMBER VOLUME BD.FT.
30	.2	765	51	3.5	28	890	0	0					
30	.0	585	44	3.7	29	730	0	0	180	7	160	0	0
40	.1	581	86	5.2	38	1410	420	0					
50	.2	573	120	6.2	48	2230	1230	0					
50	.2	573	120	6.2	48	2230	1230	0	0	0	0	0	0
60	.6	557	157	7.2	58	3300	2410	0					
70	1.0	528	189	8.1	66	4420	3610	2700					
70	.4	287	113	8.5	67	2660	2240	1800	241	76	1760	1370	900
80	.8	283	136	9.4	73	3650	3210	5300					
90	1.2	277	157	10.2	78	4570	4120	10000					
90	.7	200	120	10.5	79	3510	3180	8300	77	37	1060	940	1700
100	1.1	200	142	11.4	83	4420	4050	14400					
100	.5	82	72	12.7	85	2290	2130	7900	118	70	2130	1920	6600
110	.7	82	86	13.9	89	2890	2710	10700					
120	1.1	82	101	15.0	92	3510	3320	13800					
120	.0	23	35	16.8	94	1260	1210	5400	59	66	2250	2110	8400
130	.3	23	43	18.6	97	1600	1550	7500					
140	.5	23	51	20.2	99	1950	1890	9700					
								TOTAL YIELDS			9310	8230	26400

MERCH. CU. FT. = TREES 6.0 INCHES D.B.H. AND LARGER TO 4.0-INCH TOP.
BD. FT. = TREES 10.0 INCHES D.B.H. AND LARGER TO VARIABLE TOP LIMIT.
INITIAL THINNING MUST BE FROM BELOW.
DWARF MISTLETOE RATING ABOVE WHICH PERIODIC THINNINGS WILL NOT BE EXECUTED = 3.0.
MINIMUM CUTS FOR INCLUSION IN TOTAL YIELDS-- 260. CUBIC FEET AND 1000. BOARD FEET.
PRECOMMERCIAL INITIAL THINNING ALLOWED, NONCOMMERCIAL SUBSEQUENT THINNINGS NOT ALLOWED.
AT INITIAL AGE 30., 20. PERCENT OF THE TREES WERE INFECTED WITH DWARF MISTLETOE.

NOTE THAT NOT ALL SCHEDULED THINNINGS WERE POSSIBLE.

Table 10

YIELDS PER ACRE OF SOUTHWESTERN PONDEROSA PINE, STAND NUMBER 2.

SITE INDEX 77

THINNING INTENSITY-- INITIAL- 100, SUBSEQUENT- 100.

KAIBAB NF TUSAYAN RD MTS UNPLANTED BEFORE THINNING 1975

CHARACTERISTICS BEFORE AND AFTER THINNING									PERIODIC INTERMEDIATE CUTS				
STAND AGE (YEARS)	DMR	TREES NO.	BASAL AREA SQ.FT.	AVERAGE D.B.H. IN.	AVERAGE HEIGHT FT.	TOTAL VOLUME CU.FT.	MERCHANTABLE VOLUME CU.FT.	SAWTIMBER VOLUME BD.FT.	TREES NO.	BASAL AREA SQ.FT.	TOTAL VOLUME CU.FT.	MERCHANTABLE VOLUME CU.FT.	SAWTIMBER VOLUME BD.FT.
30	.2	765	51	3.5	28	890	0	0					
30	.0	523	41	3.8	29	670	0	0	242	10	220	0	0
40	.1	520	80	5.3	39	1300	420	0					
50	.2	518	115	6.4	49	2120	1280	0					
50	.0	316	80	6.8	49	1470	990	0	198	35	650	290	0
60	.1	314	107	7.9	56	2150	1720	0					
70	.1	310	131	8.8	64	2910	2500	2800					
70	.0	216	98	9.1	64	2230	1950	2400	94	33	680	550	400
80	.1	215	120	10.1	70	3080	2770	6100					
90	.1	215	142	11.0	75	3980	3620	11500					
90	.0	141	100	11.4	76	2820	2580	8900	74	42	1160	1040	2600
100	.1	141	118	12.4	80	3570	3300	12100					
110	.1	141	136	13.3	84	4330	4040	15400					
110	.0	98	100	13.7	85	3210	3010	11700	43	36	1120	1030	3700
120	.1	98	116	14.7	88	3860	3640	14900					
120	.0	35	51	16.3	90	1730	1650	7200	63	65	2130	1990	7700
130	.1	35	60	17.8	93	2140	2050	9600					
140	.1	35	70	19.2	95	2560	2480	12300					
						TOTAL YIELDS					8520	7380	26300

MERCH. CU. FT. = TREES 6.0 INCHES D.B.H. AND LARGER TO 4.0-INCH TOP.
BD. FT. = TREES 10.0 INCHES D.B.H. AND LARGER TO VARIABLE TOP LIMIT.
INITIAL THINNING MUST BE FROM BELOW.
DWARF MISTLETOE RATING ABOVE WHICH PERIODIC THINNINGS WILL NOT BE EXECUTED = 3.0.
MINIMUM CUTS FOR INCLUSION IN TOTAL YIELDS-- 260. CUBIC FEET AND 1000. BOARD FEET.
PRECOMMERCIAL INITIAL THINNING ALLOWED, NONCOMMERCIAL SUBSEQUENT THINNINGS NOT ALLOWED.
AT INITIAL AGE 30,, 20. PERCENT OF THE TREES WERE INFECTED WITH DWARF MISTLETOE.

Table 11

YIELDS PER ACRE OF SOUTHWESTERN PONDEROSA PINE, STAND NUMBER 2.

SITE INDEX 77

THINNING INTENSITY-- INITIAL- 60. SUBSEQUENT- 120.

KAIBAB NF TUSAYAN RD MTS UNPLANTED BEFORE THINNING 1975

CHARACTERISTICS BEFORE AND AFTER THINNING									PERIODIC INTERMEDIATE CUTS				
STAND AGE (YEARS)	DMR	TREES NO.	BASAL AREA SQ.FT.	AVERAGE D.B.H. IN.	AVERAGE HEIGHT FT.	TOTAL VOLUME CU.FT.	MERCHANTABLE VOLUME CU.FT.	SAWTIMBER VOLUME BD.FT.	TREES NO.	BASAL AREA SQ.FT.	TOTAL VOLUME CU.FT.	MERCHANTABLE VOLUME CU.FT.	SAWTIMBER VOLUME BD.FT.
30	.2	765	51	3.5	28	890	0	0					
30	.0	411	34	3.9	29	550	0	0	354	17	340	0	0
40	.1	409	70	5.6	39	1120	450	0					
50	.2	406	102	6.8	49	1880	1270	0					
50	.2	406	102	6.8	49	1880	1270	0	0	0	0	0	0
60	.6	400	129	7.7	56	2600	2040	0					
70	1.0	390	154	8.5	63	3410	2870	2700					
70	.5	272	115	8.8	64	2560	2200	2300	118	39	850	670	400
80	.9	269	138	9.7	70	3520	3130	6000					
90	1.4	264	159	10.5	75	4420	4000	10900					
90	.9	189	120	10.8	76	3360	3060	8900	75	39	1060	940	2000
100	1.5	189	141	11.7	80	4220	3880	13700					
110	2.1	175	149	12.5	84	4700	4360	16000					
110	1.8	134	120	12.8	84	3790	3520	13100	41	29	910	840	2900
120	2.6	122	125	13.7	87	4130	3870	15100					
120	1.7	48	60	15.1	89	2010	1900	7900	74	65	2120	1970	7200
130	2.4	45	67	16.5	92	2330	2230	9900					
140	3.0	41	71	17.8	94	2550	2450	11500					
							TOTAL YIELDS				7030	6870	23600

MERCH. CU. FT. = TREES 6.0 INCHES D.B.H. AND LARGER TO 4.0-INCH TOP.
BD. FT. = TREES 10.0 INCHES D.B.H. AND LARGER TO VARIABLE TOP LIMIT.
INITIAL THINNING MUST BE FROM BELOW.
DWARF MISTLETOE RATING ABOVE WHICH PERIODIC THINNINGS WILL NOT BE EXECUTED = 3.0.
MINIMUM CUTS FOR INCLUSION IN TOTAL YIELDS-- 260. CUBIC FEET AND 1000. BOARD FEET.
PRECOMMERCIAL INITIAL THINNING ALLOWED. NONCOMMERCIAL SUBSEQUENT THINNINGS NOT ALLOWED.
AT INITIAL AGE 30., 20. PERCENT OF THE TREES WERE INFECTED WITH DWARF MISTLETOE.

NOTE THAT NOT ALL SCHEDULED THINNINGS WERE POSSIBLE.

Table 12

YIELDS PER ACRE OF SOUTHWESTERN PONDEROSA PINE, STAND NUMBER 2.

SITE INDEX 77
THINNING INTENSITY-- INITIAL= 100. SUBSEQUENT= 80.

KAIBAB NF TUSAYAN RD MTS UNPLANTED BEFORE THINNING 1975

		CHARACTERISTICS BEFORE AND AFTER THINNING							PERIODIC INTERMEDIATE CUTS				
STAND AGE (YEARS)	DMR	TREES NO.	BASAL AREA SQ.FT.	AVERAGE D.B.H. IN.	AVERAGE HEIGHT FT.	TOTAL VOLUME CU.FT.	MERCHANTABLE VOLUME CU.FT.	SAWTIMBER VOLUME BD.FT.	TREES NO.	BASAL AREA SQ.FT.	TOTAL VOLUME CU.FT.	MERCHANTABLE VOLUME CU.FT.	SAWTIMBER VOLUME BD.FT.
30	.2	765	51	3.5	28	890	0	0					
30	.0	523	41	3.8	29	670	0	0	242	10	220	0	0
40	.1	520	80	5.3	39	1300	420	0					
50	.2	514	115	6.4	49	2120	1280	0					
50	.0	249	65	6.9	50	1190	850	0	265	50	930	450	0
60	.1	248	91	8.2	57	1830	1510	700					
70	.1	246	114	9.2	64	2610	2280	3200					
70	.0	158	79	9.6	65	1840	1630	2700	88	35	770	650	500
80	.1	157	98	10.7	71	2550	2310	6300					
90	.1	157	117	11.7	76	3320	3050	10700					
90	.0	100	80	12.1	77	2280	2100	7600	57	37	1040	950	3100
100	.1	100	96	13.3	81	2940	2740	10500					
100	.0	41	48	14.7	83	1500	1420	5800	59	48	1440	1320	4700
110	.1	41	59	16.2	86	1920	1830	8000					
120	.1	41	69	17.6	90	2360	2270	10500					
120	.0	12	25	19.4	92	860	850	4200	29	44	1500	1440	6300
130	.1	12	30	21.4	95	1080	1060	5700					
140	.1	12	36	23.3	97	1320	1290	7400					
							TOTAL YIELDS				7220	6100	21500

MERCH. CU. FT. = TREES 6.0 INCHES D.B.H. AND LARGER TO 4.0-INCH TOP.
BD. FT. = TREES 10.0 INCHES D.B.H. AND LARGER TO VARIABLE TOP LIMIT.
INITIAL THINNING MUST BE FROM BELOW.
DWARF MISTLETOE RATING ABOVE WHICH PERIODIC THINNINGS WILL NOT BE EXECUTED = 3.0.
MINIMUM CUTS FOR INCLUSION IN TOTAL YIELDS-- 260. CUBIC FEET AND 1000. BOARD FEET.
PRECOMMERCIAL INITIAL THINNING ALLOWED, NONCOMMERCIAL SUBSEQUENT THINNINGS NOT ALLOWED.
AT INITIAL AGE 30., 20. PERCENT OF THE TREES WERE INFECTED WITH DWARF MISTLETOE.

Table 13